Application No.: 09/288,943
Amendment dated: 10/16/03
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Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application. Claims 1-20 were previously cancelled April 8, 1999 and claims 21-31 were previously cancelled April 13, 2000.

Listing of Claims:

32. (cancelled) A refurbished gas turbine engine component having at least one knife edge seal for inhibiting air leakage through an intercomponent gap between the component and a second component, the refurbished component characterized by:

a brush seal mounted on the refurbished component in tandem with the knife edge seal, the bristles of the brush seal extending toward the second component for impeding the leakage of air through the intercomponent gap.

33. (cancelled) The refurbished component of Claim 32 characterized in that the component comprises two component segments, the brush seal is also segmented and the brush seal segments are mounted in a circumferentially extending groove so that the seal is installable and removable by separating the component segments and sliding the brush seal segments circumferentially in the groove.

34. (cancelled) A method of improving the air sealing effectiveness between a rotating component and a nonrotating component in a turbine engine, the rotating and nonrotating components being separated by a gap with knife edge seals extending across the gap to inhibit leakage of air therethrough, the method characterized by:

providing a brush seal;

reconfiguring the nonrotating component to provide means for receiving and retaining the brush seal in tandem with the knife edge seals; and

installing the brush seal so that the seal bristles extend toward the rotating component to impede the flow of air through the gap, the brush seal being retained by the receiving and retaining means.

35. (cancelled) The method of Claim 34 wherein the nonrotating component is hollow and substantially cylindrical and has a wall thickness and a face, the method characterized in that the step of reconfiguring the nonrotating component includes:

creating a capture slot in the faced of the nonrotating component for radially retaining the brush seal; and

attaching a retainer to the nonrotating component so that the retainer cooperates with the face to axially trap the brush seal.

36. (cancelled) The method of Claim 35 characterized in that the reconfiguring step includes reducing the wall thickness by a predefined amount in the vicinity of the face to form a seal seat and accommodate the radial dimension of the brush seal.

37. (cancelled) The method of Claim 35 characterized in that the reconfiguring step regulates the axial length of the nonrotating component.

38. (cancelled) The method of Claim 34 wherein the brush seal is a multilayered brush seal.

39. (cancelled) The method of Claim 34 wherein the nonrotating component comprises upper and lower component segments each component segment subtending approximately 180 degrees of arc, and the brush seal comprises an upper brush seal segment subtending approximately 180 degrees of arc and one or more lower brush seal segments, the lower brush seal segments collectively subtending approximately 180 degrees of arc.

40. (cancelled) A method of improving the air sealing effectiveness between a rotating component and a nonrotating component in a turbine engine, the nonrotating component being hollow and substantially cylindrical and having a wall thickness and a face,

the rotating and nonrotating components being separated by a gap with knife edge seals extending across the gap to inhibit leakage of air therethrough, the method characterized by:

reconfiguring the nonrotating component by reducing its axial length by a predetermined amount and reducing its wall thickness in the vicinity of the face by a predefined amount whereby a seal seat is formed;

creating an axially and circumferentially extending capture slot in the face of the nonrotating component;

attaching a retainer to the face so that the retainer cooperates with the face and the seal seat to define a circumferentially extending groove; and

installing a brush seal in the groove so that the bristles of the seal extend toward the rotating component to impede the flow of air through the gap;

the brush seal being radially retained by the capture slot and the seal seat and axially retained by the retaining ring and the face.

41. A stationary gas turbine engine for a power plant, comprising:

(a) a multistage axial compressor, the compressor having a rotor, the rotor having a cylindrical land region downstream of a last-stage of the compressor, the land region having an outside diameter D;

(b) a turbine shaft-coupled to the rotor of the compressor;

(c) a combustor fluid coupled between the compressor and the turbine;

(d) a stationary inner barrel member downstream of the compressor, air flowing from the compressor to the combustor passing outside of the inner barrel member, a chamber within the inner barrel member forming a passage for cooling air from the compressor, the cooling air flowing from the chamber and being mixed with combustion gases upstream of the turbine;

(e) a brush seal for restricting air passage into the chamber from the compressor, the brush seal comprising:

(i) a ring-shaped holder;

(ii) a multiplicity of bristle members extending radially inwardly from the holder toward the land region of the rotor, outer extremities of the bristle members being rigidly retained relative to the holder; and

(iii) means for fastening the holder to the inner barrel member,

wherein, when the power plant is inactive, the bristles have an ambient temperature clearance of not less than 0.015 percent of the diameter D from the land region of the rotor.

42. A stationary gas turbine engine for a power plant, comprising:

(a) a multistage axial compressor, the compressor having a rotor, the rotor having a cylindrical land region downstream of a last-stage of the compressor, the land region having an outside diameter D;

(b) a turbine shaft-coupled to the rotor of the compressor;

(c) a combustor fluid coupled between the compressor and the turbine;

(d) a stationary inner barrel member downstream of the compressor, air flowing from the compressor to the combustor passing outside of the inner barrel member, a chamber within the inner barrel member forming a main passage and containing a labyrinth seal comprising at least one knife-edge member positioned on the barrel member for controlling air leakage through the labyrinth for cooling air from the compressor, the cooling air flowing from the chamber and being mixed with combustion gases upstream of the turbine; and

(e) a brush seal positioned on the barrel member and upstream from the labyrinth seal for restricting air passage into the chamber from the compressor, the brush seal comprising:

(i) a ring-shaped holder;

(ii) a multiplicity of bristle members extending radially inwardly from the holder toward the land region of the rotor, outer extremities of the bristle members being rigidly retained relative to the holder; and

(iii) the holder being fastened to the inner barrel member,

wherein, when the power plant is inactive, the bristles have an ambient temperature clearance of not less than 0.015 percent of

the diameter D from the land region of the rotor and whereby air flow into the compressor is impeded.

43. The engine of Claim 42, further comprising a barrel passage extending through one wall of the inner barrel for passing air therethrough downstream of the brush seal, thereby altering the flow of cooling air from the chamber to be mixed with the combustion gases upstream of the turbine.

44. The engine of Claim 43, further comprising a structure for restricting the barrel passage.

45. The engine of Claim 42, further comprising an insert ring connecting segments of the inner barrel member, the insert ring being located proximate the land region of the rotor, the holder being fastened to the insert ring by a plurality of threaded fasteners.

46. The engine of Claim 45, wherein the brush seal, including the holder thereof is segmented for facilitating assembly with the insert ring.

47. In a turbine power plant having a multistage axial compressor, a turbine shaft-coupled to a rotor of the compressor, a combustor fluid-coupled between the compressor and the turbine, and a labyrinth seal between the rotor and a stationary inner barrel member, the rotor having a cylindrical land region of diameter D, the improvement comprising a brush seal connected to the inner barrel and augmenting the labyrinth seal, being fluid connected in series therewith, the brush seal comprising:

(a) a ring-shaped holder;

(b) a multiplicity of bristle members extending radially inwardly from the holder toward the land region of the rotor, outer extremities of the bristle members being rigidly retained relative to the holder; and

(c) the holder being fastened to the inner barrel member,

wherein, when the power plant is inactive, the bristles have an ambient temperature clearance of not less than 0.015 percent of the diameter D from the land region of the rotor.

48. A method for controlling cooling air flow in a turbine power plant having a multistage axial compressor, a turbine shaft-coupled to a rotor of the compressor, a combustor fluid-coupled between the compressor and the turbine, and a labyrinth seal between the rotor and a stationary inner barrel member, the rotor having a cylindrical land region of diameter D, comprising the steps of:

(a) providing a brush seal having a ring-shaped holder, a multiplicity of bristle members extending radially inwardly from the holder toward the land region of the rotor, outer extremities of the bristle members being rigidly retained relative to the holder;

(b) connecting the brush seal in augmenting relation to the labyrinth seal;

and

(c) spacing the bristle members from the land region of the rotor by an ambient temperature clearance of not less than 0.015 percent of the diameter D when the power plant is inactive.

49. The method of Claim 48, wherein the power plant includes an insert ring fastened to the inner barrel member in axially spaced relation to a portion of the rotor member, the method comprising the further steps of:

(a) removing the insert ring from the inner barrel member;

(b) providing an adapter ring;

(c) mounting the brush seal to the adapter ring; and

(d) fastening the adapter ring to the inner barrel member in place of the insert ring.

50. The method of Claim 49, wherein the step of providing the adapter ring comprises the step of modifying the insert ring.

51. The engine of Claim 43, wherein the barrel passage is one of a plurality of barrel passages.

52. A method for generating electrical power comprising the steps of:

(a) providing the improved power plant of Claim 47; and

(b) monitoring an operating parameter of the power plant.